







AERONAUTICS DIVISION



ACKNOWLEDGEMENTS

The preparation of the Navigational Aids and Aviation Services Special Study incorporated input from the aviation public and private sectors as members of a Project Advisory Committee and through the course of pilot information meetings. Those participating as member of the Committee are listed below. The insight they provided from their industry perspectives to the formulation of the Study recommendations is greatly appreciated.

Project Advisory Committee

Wayland Adams, Honeywell Commuter Aviation
Roger Carlin, Helicopters Association International
Michael Covalt, Arizona Airports Association
Richard Dawson, AIREvac
Dean Fish, Sawyer Aviation
Chad Haring, Allied Signal Engines
Stacy Howard, Aircraft Owners and Pilots Association
Sean Jeralds, Embry-Riddle Aeronautical University
Denis Kelleher, Honeywell Commuter Aviation
Michael Lewis, Mesa Airlines
Skip Paschke, FAA Phoenix TRACON
Darrell Purcell, Arizona Airports Association
Arvin Schultz, "Arizona Flyways"
James Timm, Arizona Pilots Association
Harry Wolfe, Maricopa Association of Governments

QED and ADOT Aeronautics also wish to recognize those pilots who attended the briefing meetings for their input. These combined outreach efforts served to enhance the Study and establish a basis from which future improvements to the Arizona system of airports can be implemented.



November 30, 1998

Mr. Gary Adams
Director
Arizona Department of Transportation
Aeronautics Division
1833 West Buchanan Street
Phoenix, Arizona 85007-3335

Dear Mr. Adams:

QED is pleased to submit the Navigational Aids and Aviation Services Special Study.

The Study represents many months of intensive evaluation, documentation, review and discussion among the participants in the effort. Special recognition should be given to the contributions of the members of the project advisory committee and the staff of the Aeronautics Division.

We trust that this document will serve as a working guideline for implementation of instrument approach procedures, visual landing aids, communications, weather facilities and aviation services to enhance flight safety in Arizona. The benefits of these facilities and services will be enjoyed by users of the airport and aviation system as well as potentially other segments of the Arizona public and private economies.

We are pleased to have had this opportunity to assist the Division in this progressive effort.

Sincerely,

Ronald F. Price, P.E.

Ronald D. Price

Principal

RFP/pss Enclosure



TABLE OF CONTENTS

Chapter		Page
ES	Executive Summary	ES-1
1	Introduction	1-1
2	Existing System Facilities	2-1
	Introduction	2-1
	NAVAIDS, VISAIDS and Communications	2-1
	Air Traffic Control Radar Coverage	
	Aviation Weather	2-29
	METAR Dissemination	2-38
	Weather Radar	
	AFSS / FSS Services	
	Commercial Vendor Services	
	Communications Facilities	2-44
3	Forecasts of Aviation Demand	3-1
	Introduction	
	Socioeconomic Characteristics	3-1
	Registered Pilots	3-2
	Registered Aircraft	3-8
	General Aviation Activity	3-10
	IFR Peak-Hour Aircraft Operations	3-16
	IFR Peak-Hour Capacity	3-16
4	Technological Assessment	4-1
	Introduction	4-1
	Navigation	4-1
	Communications	4-8
	Surveillance	4-9
	Flight Services	4-10

Cnapter		Page
5	Instrument Approach Procedures Analysis	5- <i>-</i>
	Introduction	5- ⁻
	Existing Instrument Approach Procedures	
	Desired Instrument Approach Capability	5-1
	GPS Analysis	5-22
	GPS Analysis Findings	5-23
	Benefit / Cost Assessment	5-47
	Airport System Services	5-54
	GPS Approach Recommendations	5-57
	Differential GPS	5-79
	Instrument Approach Training	5-79
6	VISAID Facility Requirements	6-1
7	Weather Facility Requirements	7-1
	Introduction	7-1
	AWOS Requirements	7-1
	Broadcast	7-23
	AWOS-3 Upgrades	7-24
8	Remote Communications Outlet Requirements	8-1
9	Aviation Services Assessment	9-1
	Introduction	9-1
	Service Needs That Are Being Met	9-1
	Service Needs That Are Not Being Met	9-2
	Potential ADOT Aeronautics Initiatives	9-4
	Weather Data Network	10_1
	Introduction	10-1 10-1
	Conceptual Network	10-1 10.1
	Recommended AWOS Network Topology	10-1

Chapter		Page
11	Implementation Program Introduction GPS Approach Procedures AWOS Facilities Weather Center VISAIDS GCO Facilities Establishment and Operating Costs Funding Options Maintenance Costs Telecommunications Costs State Versus Contract Management Public Versus Private Funding Participation	11-1 11-2 11-8 11-8 11-14 11-11 11-21 11-23
Appendi	x	
A B C D E F G	Glossary General Aviation Pilot Survey Airport Owner / Sponsor Survey Fixed Base Operator / Tenant Survey Weather Information Use Survey Automated Weather Facilities Project Advisory Committee Meeting Minutes Pilot Information Meetings	B-1 D-1 E-1 F-1
Table		
2-1 2-2	Existing Facilities Summary - Terminal NAVAIDS and VISAIDS Existing Facilities Summary -	
2-3	Weather Facilities and Communications Outlets Existing Off-Airport NAVAIDS and Communications Outlets	2-25-27
2-4 2-5 2-6 2-7 3-1	Manned Weather Observation Sites ASOS Service Standard Levels (C and D) and (A and B) AWOS Levels and Reports Existing Weather Radar Facilities Registered General Aviation Pilots	2-31 2-35-36 2-37 2-40
3-2 3-3	Registered Commercial Pilots	3-5

lable		Page
3-4	Total Registered Pilots	3-7
3-5	Total Registered Aircraft	
3-6	General Aviation Aircraft Operations	3-11-15
3-7	IFR Peak-Hour Demand / Capacity	3-17-19
5-1	Existing Instrument Approach Procedures	5-3-10
5-2	Desired / Target Instrument Approach Capability	5-13-21
5-3	Initial GPS Analysis	5-25-40
5-4	Initial GPS Analysis Grouping	5-44-46
5-5	Benefit / Cost Assessment for Selected Airports	5-50-53
5-6	Final GPS Analysis	
5-7	Summary of Final GPS Analysis	5-73-75
6-1	Minimum Guidelines for Visual Landing Aids -	
0.0	Primary Runway	6-2
6-2	VISAID Facility Requirements - Primary Runway	6-3-8
7-1	AWOS / ASOS Backbone System	7-6
7-2	AWOS Scenario 1	7-10
7-3	Final AWOS Requirements	7-20
11-1	GPS Approaches Staging Program - Initial Stage (Years 1-4)	11-5
11-2	GPS Approaches Staging Program-	
44.0	Intermediate Stage (Years 5-7)	11-6
11-3	GPS Approaches Staging Program - Final Stage (Years 8-10) 11-7
11-4	AWOS Facilities Staging Program - Initial Stage (Years 1-4) .	11-9
11-5	AWOS Facilities Staging Program -	
11-6	Intermediate Stage (Years 5-7) and Final Stage (Years 8-1))) 11-10
11-7	Unit Establishment and Annual Maintenance Costs	11-13
11-8	Staged Establishment and Annual Costs	11-14
11-0 11-9	System Airport Facility Establishment Costs	11-15-21
11-9 11-10	Funding Participation Scenarios	11-24
11-10	Establishment Funding Sources Scenarios	11-25
11-11	Weather Center Organization - Public Sector Option	11-28
11-12 11-13	Weather Center Organization - Private Sector Option	11-29
11-13	Weather Center Organization -	
	Public / Private Partnership Option	11-30

Figure		Page
2-1	Existing Weather Observation Sites	2-33
2-2	Existing NEXRAD Weather Radar Coverage	2-41
5-1	Existing System Area Coverage - 1/2-Mile Visibility Minimum	5-55
5-2	Final System Area Coverage - 1/2-Mile Visibility Minimum	5-77
7-1	AWOS / ASOS Backbone System	7-7
7-2	AWOS Scenario 1 - Backbone and AWOS-3's with	
	Benefit / Cost ≥ 1.0	7-11
7-3	AWOS Scenario 2 - AWOS Scenario 1 and Strategic AWOS-3	
	Locations at IAP Airports	7-13
7-4	AWOS Scenario 3 - AWOS Scenario 2 and AWOS-3's for	
	Increased Coverage	7-17
7-5	Final AWOS Requirements	7-21
7-6	AWOS-4 Locations- Potential Upgrade	
10-1	AWOS Weather Network Concept	10-5